



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
UNDERGROUND INJECTION CONTROL PERMIT: CLASS I NON-HAZARDOUS

Permit Number: IN-083-11-0001

Facility Name: WDW #1

Pursuant to the Underground Injection Control regulations of the U.S. Environmental Protection Agency codified at Title 40 of the Code of Federal Regulations (40 CFR), Parts 124, 144, 146, and 147,

**Duke Energy Indiana, Inc. of Plainfield, Indiana**

is hereby authorized to construct and operate a newly drilled Class I non-hazardous injection well located in Indiana, Knox County, T4N, R8W, Section 12, NE Quarter Section, for injection into the Trenton Limestone, Plattin Formation, Pecatonica Formation, Dutchtown Formation, St. Peter Sandstone, Shakopee Dolomite, Oceata Dolomite, Potosi Dolomite, Eau Claire, Mount Simon Sandstone, and Precambrian Granite at depths between 3930 feet and 10000 feet upon the express condition that the permittee meet the restrictions set forth herein. The injection of any hazardous waste as specified in 40 CFR Part 261 is prohibited. Injection shall not commence until the operator has received authorization in accordance with Part I(J) of this permit.

The purpose of the injection is limited to the disposal of fresh water for the purpose of performing formation tests.

All references to Title 40 of the Code of Federal Regulations are to all regulations that are in effect on the date that this permit is effective. The following attachments are incorporated into this permit: A, B, C, D, E, and F.

This permit shall become effective on MAR - 2 2009, and shall remain in full force and effect during the life of the permit, unless this permit is revoked, terminated, modified or reissued pursuant to 40 CFR §§144.39, 144.40 or 144.41. The permit will expire in two and one half years if the permittee fails to commence construction, unless a written request for an extension of this two and one half year period has been approved by the Director. The permittee may request an expiration date sooner than the two and one half year period, provided no construction on the well has commenced.

This permit and authorization to inject shall expire at midnight on March 2, 2019, unless terminated prior to the expiration date.

Signed and Dated:

January 29, 2009  
Ruth 20 Hany  
FOR

Tinka G. Hyde  
Director, Water Division

**PART I**  
**GENERAL PERMIT COMPLIANCE**

**A. EFFECT OF PERMIT**

The permittee is allowed to engage in underground injection in accordance with the conditions of this permit. Notwithstanding any other provisions of this permit, the permittee authorized by this permit shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of injection, annulus or formation fluids into underground sources of drinking water (USDWs). The objective of this permit is to prevent the introduction of any contaminant into USDWs if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 141 or may otherwise adversely affect the health of persons. Any underground injection activity not specifically authorized in this permit is prohibited. For purposes of enforcement, compliance with this permit during its term constitutes compliance with Part C of the Safe Drinking Water Act (SDWA). Such compliance does not constitute a defense to any action brought under Section 1431 of the SDWA, or any other common or statutory law other than Part C of the SDWA. Issuance of this permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulations. Nothing in this permit shall be construed to relieve the permittee of any duties under applicable regulations.

**B. PERMIT ACTIONS**

1. **Modification, Revocation, Reissuance and Termination** - The Director of the Water Division of the United States Environmental Protection Agency (USEPA), hereinafter, the Director, may, for cause or upon request from the permittee, modify, revoke and reissue, or terminate this permit in accordance with 40 CFR 144.12, 144.39, and 144.40. Also, the permit is subject to minor modifications for cause as specified in 40 CFR 144.41. The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes, or anticipated noncompliance on the part of the permittee does not stay the applicability or enforceability of any permit condition. It has been determined that a major modification is needed to modify the permit to allow injection of waste that has been determined to be nonhazardous based on the Bevill Amendment, and that a new permit, among other things, is needed to allow injection of hazardous waste.
2. **Transfer of Permits** - This permit is not transferable to any person except in accordance with 40 CFR 144.38.

**C. SEVERABILITY**

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

**U.S. ENVIRONMENTAL PROTECTION AGENCY**  
**UNDERGROUND INJECTION CONTROL PERMIT**  
**CLASS I NONHAZARDOUS**



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submission, the USEPA may make the information available to the public without further notice. If a claim is asserted, the validity of the claim will be assessed in accordance with the procedures in 40 CFR Part 2 (Public Information). Claims of confidentiality for the following information will be denied:

1. The name and address of the permittee; and
2. Information which deals with the existence, absence or level of contaminants in drinking water.

#### E. DUTIES AND REQUIREMENTS

1. **Duty to Comply** - The permittee shall comply with all applicable Underground Injection Control (UIC) Program regulations and conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit issued in accordance with 40 CFR 144.34. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application.
2. **Penalties for Violations of Permit Conditions** - Any person who violates a permit requirement is subject to civil penalties, fines and other enforcement action under the SDWA. Any person who willfully violates permit conditions may be subject to criminal prosecution.
3. **Continuation of Expiring Permits**
  - (a) **Duty to Reapply** - If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must submit a complete application for a new permit at least 60 calendar days before this permit expires.
  - (b) **Permit Extensions** - The conditions of an expired permit may continue in force in accordance with 5 U.S.C. 558(c) and 40 CFR 144.37.
  - (c) **Effect** - Permits continued under 5 U.S.C. 558(c) and 40 CFR 144.37 remain fully effective and enforceable.
  - (d) **Enforcement** - When the permittee is not in compliance with the conditions of the expiring or expired permit, the Director may choose to do any or all of the following:
    - (1) Initiate enforcement action based upon the permit which has been continued;
    - (2) Issue a notice of intent to deny the new permit, in which case the owner or operator would then be required to cease the activities authorized by the continued permit or be subject to enforcement action for operation without a permit;
    - (3) Issue a new permit under 40 CFR Part 124 with appropriate conditions; or

- (4) Take other actions authorized by the UIC regulations.
- (e) **State Continuation** - A USEPA-issued permit does not continue in force beyond its expiration date under Federal law if at that time a State has primary enforcement responsibility under the SDWA. A State approved to administer the UIC program may continue either USEPA or State-issued permits until the effective date of the new permits, if State law allows. Otherwise, the facility or activity is operating without a permit from the time of expiration of the old permit to the effective date of the State-issued new permit. Furthermore, if the State does not continue the USEPA permit upon obtaining primary enforcement responsibility, the permittee must obtain a new State permit or be authorized to inject by State rule. Failure to do so while continuing to operate the well constitutes unauthorized injection and is a violation subject to enforcement action.
4. **Need to Halt or Reduce Activity Not a Defense** - It shall not be a defense for the permittee in an enforcement action to claim that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.
5. **Duty to Mitigate** - The permittee shall take all timely and reasonable steps necessary to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.
6. **Proper Operation and Maintenance** - The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control and related appurtenances which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit.
7. **Duty to Provide Information** - The permittee shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.
8. **Inspection and Entry** - The permittee shall allow the Director or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:
- (a) Enter, at reasonable times, upon the permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this permit;
- (b) Have access to and copy, at reasonable times, any records that are kept under the conditions of this permit;



- (c) Inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
- (d) Sample or monitor, at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the SDWA, any substances or parameters at any facilities, equipment or operations regulated or required under this permit.

9. **Records**

- (a) The permittee shall retain records and all monitoring information, including all calibration and maintenance records and all original chart recordings for continuous monitoring instrumentation and copies of all reports required by this permit for a period of at least three (3) years from the date of the sample, measurement or report, unless these materials are submitted to the Director as part of reporting requirements under this permit.
- (b) The permittee shall maintain records of all data required to complete the permit application form for this permit and any supplemental information submitted under 40 CFR 144.27, 144.28, and 144.31 for a period of at least three (3) years from the date the permit application was signed.
- (c) The permittee shall retain records concerning the nature and composition of all injected fluids until three (3) years after the completion of plugging and abandonment of this injection well.
- (d) The retention period specified in Part I(E)(9)(a) through (c) of this permit may be extended by request of the Director at any time. The permittee shall continue to retain records after the retention period specified in Part I(E)(9)(a) through (c) of this permit or any requested extension thereof expires unless the permittee delivers the records to the Director or obtains written approval from the Director to discard the records.
- (e) Records of monitoring information shall include:
  - (1) The date, exact place, and time of sampling or measurements;
  - (2) The name(s) of individual(s) who performed the sampling or measurements;
  - (3) A precise description of both sampling methodology and the handling of samples;
  - (4) The date(s) analyses were performed;
  - (5) The name(s) of individual(s) who performed the analyses;
  - (6) The analytical techniques or methods used; and
  - (7) The results of such analyses.

10. **Monitoring** - Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The permittee shall use the methods identified in the approved Waste Analysis Plan found in Part III(F) of this permit. Monitoring results shall be reported at the intervals contained in Part II(D)(1) through (3) and Part III(A) of this permit.
  - (a) Monitoring of the nature of injected fluids shall comply with applicable analytical methods cited and described in Table I of 40 CFR 136.3 or in certain circumstances by other methods that have been approved by the Director.
  - (b) Sampling and analysis shall comply with the specifications of the Waste Analysis Plan required in Part II(C)(3) of this permit.
11. **Signatory Requirements** - All reports or other information, required to be submitted by this permit or requested by the Director shall be signed and certified in accordance with 40 CFR 144.32.
12. **Reporting Requirements**
  - (a) **Planned Changes** - The permittee shall give written notice to the Director, as soon as possible, of any planned physical alterations or additions to the permitted facility other than minor repair/replacement maintenance activities.
  - (b) **Anticipated Noncompliance** - The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
  - (c) **Compliance Schedules** - Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted by the permittee no later than thirty (30) calendar days following each schedule date.
  - (d) **Twenty-four Hour Reporting**
    - (1) The permittee shall report to the Director any permit noncompliance which may endanger human health or the environment. See, e.g., Part I(G)(5) of this permit. Any information shall be provided orally within twenty-four (24) hours from the time the permittee becomes aware of the circumstances. Such reports shall include, but not be limited to the following information:
      - (i) Any monitoring or other information which indicates that any contaminant may cause an endangerment to a USDW; and
      - (ii) Any noncompliance with a permit condition, or malfunction of the injection system, which may cause fluid migration into or between USDWs; and
      - (iii) Any failure to maintain mechanical integrity.

- (2) A written submission shall also be provided within five (5) working days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate and prevent recurrence of the noncompliance.
- (e) **Other Noncompliance** - The permittee shall report all other instances of noncompliance not otherwise reported at the time monitoring reports are submitted. The reports shall contain the information listed in Part I(E)(12)(d)(2) of this permit.
- (f) **Other Information** - When the permittee becomes aware of failure to submit any relevant facts in the permit application or that incorrect information was submitted in a permit application or in any report to the Director, the permittee shall submit such facts or corrected information within ten (10) calendar days.
- (g) **Report on Permit Review** - Within thirty (30) calendar days of receipt of this permit, the permittee shall certify to the Director that he or she has read and is personally familiar with all terms and conditions of this permit.

#### F. **PLUGGING AND ABANDONMENT**

1. **Notice of Plugging and Abandonment** - The permittee shall notify the Director at least sixty (60) calendar days before conversion or abandonment of the well. At the discretion of the Director, a shorter notice period may be allowed.
2. **Plugging and Abandonment** - The permittee must receive the approval of the Director before plugging the well and shall plug and abandon the well consistent with 40 CFR 144.52(a)(6) and 146.10, as provided for in the Plugging and Abandonment Plan contained in Part III(B) of this permit. Within sixty (60) calendar days after plugging a well, the permittee shall submit a Plugging and Abandonment report to the Director. The report shall be certified as accurate by the permittee and by the person who performed the plugging operation (if other than the permittee), and shall consist of either:
  - (a) A statement that the well was plugged in accordance with the Plugging and Abandonment Plan previously approved by the Director; or
  - (b) If the actual plugging differed from the approved plan, a statement defining the actual plugging and explaining why the Director should approve such deviation. If the Director determines that a deviation from a previously approved plan may endanger underground sources of drinking water, the permittee shall replug the well as required by the Director.
3. **Temporary Abandonment** - If the permittee ceases injection into the well for more than twenty-four (24) consecutive months, the well is considered to be in temporary abandoned status, and the permittee shall plug and abandon the well in accordance with the approved plan and 40 CFR 144.52 (a)(6), or make another demonstration of non-endangerment (e.g., a standard annulus pressure test). During any periods of



temporary abandonment or disuse, the well will be tested to ensure that it maintains mechanical integrity. Demonstrations of non-endangerment/testing will be due every two years from the last successful test (unless the permit requires more frequent demonstrations of mechanical integrity). If the well loses mechanical integrity prior to the next test due date, then the well must either be plugged or repaired and retested within 30 days of losing mechanical integrity. The permittee shall continue to comply with the conditions of this permit, including all monitoring and reporting requirements according to the frequencies outlined in the permit.

4. **Revision of Plugging and Abandonment Plan** - If the permittee finds it necessary to change a Plugging and Abandonment Plan, a revised plan shall be submitted to the Director for approval at the time of the next monthly report.
5. **Standards for Well Closure** - Prior to plugging and abandoning the well:
  - (a) The permittee shall observe and record the pressure decay for a time specified by the Director and shall report this information to the Director.
  - (b) The permittee shall conduct appropriate mechanical integrity testing to ensure the integrity of that portion of the long string casing and cement that will be left in the ground after closure. Testing methods must include:
    - (1) Pressure tests with liquid;
    - (2) Noise, temperature, or oxygen activation logs; or
    - (3) Any other test required by the Director.
  - (c) Prior to well closure, the well shall be flushed with a buffer fluid.

#### G. **MECHANICAL INTEGRITY**

1. **Standards** - The injection well must have and maintain mechanical integrity consistent with 40 CFR Section 146.8(a)(1) and (2). To meet these requirements, an authorized representative of the Director must witness mechanical integrity demonstrations unless it proves impossible to resolve scheduling conflicts between the operator and the agency. In order to conduct testing without a USEPA representative, the following procedures must be followed.
  - (a) The owner/operator must submit proposed procedures including the information that no USEPA representative is available, and receive permission from the Direct Implementation Section of the UIC Branch to proceed;
  - (b) The test must be documented using either a mechanical or digital device which records the value of the parameter of interest, or by a service company job record;
  - (c) A report of the testing including all data available at the conclusion of the test and a certification of accuracy which is signed by an authorized representative of the company must be submitted to the Direct Implementation Section within ten calendar days of the completion of testing; and

- (d) A final report including any additional interpretation necessary for evaluation of the testing must be submitted prior to or with the next regularly scheduled monitoring report or as required under the appropriate permit for the injection well.

2. **Periodic Mechanical Integrity Testing [§146.8]** - The permittee shall conduct the mechanical integrity testing as follows:

- (a) Long string casing, injection tubing and annular seal shall be tested by means of an approved pressure test in accordance with 40 CFR 146.8(b)(2). This test shall be performed upon completion of this well, and at least once before or on the anniversary date of the last approved demonstration and whenever there has been a well workover in which tubing is removed from the well, the packer is reset, or when loss of mechanical integrity becomes suspected during operation;
- (b) An approved temperature, noise, oxygen activation, or other approved log shall be run upon completion of this well and at least once every sixty (60) months from the date of the last approved demonstration to test for movement of fluid along the bore hole. The Director may require such tests whenever the well is worked over. The permittee must submit logging procedures to the Director for approval before running logs for the purpose of meeting this requirement.
- (c) The permittee may request the Director to use any other test approved by the Director in accordance with the procedures in 146.8(d).

3. **Prior Notice and Reporting** - The permittee shall notify the Director of his or her intent to demonstrate mechanical integrity at least thirty (30) calendar days prior to such demonstration. At the discretion of the Director a shorter time period may be allowed. Reports of mechanical integrity demonstrations which include logs must include an interpretation of results by a knowledgeable log analyst. The permittee shall report the results of a mechanical integrity demonstration within forty-five (45) calendar days after completion thereof.

4. **Gauges** - The permittee shall calibrate all gauges used in mechanical integrity demonstrations to an accuracy of not less than one-half (0.5) percent of full scale, prior to each required test of mechanical integrity. A copy of the calibration certificate shall be submitted to the Director or his or her representative at the time of demonstration and every time the gauge is calibrated. The gauge shall be marked in no greater than five (5) psi increments.

5. **Loss of Mechanical Integrity** - If the permittee or the Director finds that the well fails to demonstrate mechanical integrity during a test, or fails to maintain mechanical integrity during operation, or that a loss of mechanical integrity as defined by 40 CFR 146.8(a)(1) and (2) is suspected during operation, the permittee shall halt the operation immediately and follow the reporting requirements as directed in Part I(E)(12) of this permit. The permittee shall not resume operation until mechanical integrity is demonstrated and the Director gives approval to recommence injection.

6. **Mechanical Integrity Testing on Request From Director** - The permittee shall demonstrate mechanical integrity at any time upon written notice from the Director.

## H. FINANCIAL RESPONSIBILITY

1. **Financial Responsibility** - The permittee shall maintain financial responsibility and resources to close, plug, and abandon the underground injection operation in a manner consistent with 40 CFR 144.52(a)(7). The approved financial assurance mechanism is found in Part III(C) of this permit.
  - (a) The permittee must maintain a written cost estimate, in current dollars, for the Plugging and Abandonment Plan as specified in 40 CFR 146.10. The plugging and abandonment cost estimate at any point in the life of the facility operation must equal the maximum cost of plugging and abandonment at that time.
  - (b) The permittee must adjust the cost estimate of plugging and abandonment for inflation within thirty (30) calendar days after each anniversary of the first estimate. The inflation factor is the result of dividing the latest published annual Oil and Gas Field Equipment Cost Index by the index for the previous year.
  - (c) The permittee must revise the plugging and abandonment cost estimate whenever a change in the Plugging and Abandonment Plan increases the cost of plugging and abandonment.
  - (d) If the revised plugging and abandonment estimate exceeds the current amount of the financial assurance mechanism, the permittee shall submit a revised mechanism to cover the increased cost within thirty (30) calendar days after the revision specified in Part I(H)(1)(b) and (c) of this permit.
  - (e) The permittee must keep on file at the facility a copy of the latest plugging and abandonment cost estimate prepared in accordance with 40 CFR 144.52(a)(7), during the operating life of the facility.
2. **Insolvency** - The permittee must notify the Director within ten (10) business days of any of the following events:
  - (a) The bankruptcy of the trustee or issuing institution of the financial mechanism; or
  - (b) Suspension or revocation of the authority of the trustee institution to act as trustee; or
  - (c) The institution issuing the financial mechanism losing its authority to issue such an instrument.
3. **Notification** - The permittee must notify the Director by certified mail of the commencement of voluntary or involuntary proceedings under Title 11 (Bankruptcy), U.S. Code naming the owner or operator as debtor, within ten (10) business days after the commencement of the proceeding. A guarantor of a corporate guarantee must make such a notification if he or she is named as debtor, as required under the terms of the guarantee.



4. **Establishing Other Coverage** - The owner or operator must establish other financial assurance or liability coverage acceptable to the Director, within sixty (60) calendar days of the occurrence of the events in Part I(H)(2) or (H)(3) of this permit.

#### I. **CORRECTIVE ACTION**

1. **Compliance** - The permittee shall comply with 40 CFR 144.55 and 146.7.
2. **Corrective Action Plan** - The permittee shall file a Corrective Action Plan for approval by the Director within thirty (30) days of a written determination by the Director that improperly plugged, completed, or abandoned wells, or wells for which plugging or completion information is unavailable, are present in the area of review and penetrate the confining zone of the permitted well, as defined in the administrative record for this permit.
3. **Prohibition of Movement of Fluids into USDWs [§144.12]** Should upward migration of fluids through the confining zone of this permitted well be discovered within the two mile area of review due to injection activities at this facility, and should this migration of fluids cause the introduction of any contaminant into a USDW pursuant to 40 CFR 144.12, the permittee shall immediately cease injection into this well until the situation has been corrected and reauthorization to inject has been given by the Director.

#### J. **COMMENCING INJECTION**

The permittee may not commence injection until:

1. Results of the formation testing and logging program as specified in the administrative record of this permit are submitted to and approved by the Director; and
2. Mechanical integrity of the well has been demonstrated in accordance with 40 CFR 146.8(a)(1) and (2) and in accordance with Part I(G)(1) through (3) of this permit; and
3. Results from ambient monitoring as required in Part II(C)(4) of this permit have been submitted and approved by the Director; and
4. All required corrective action has been taken in accordance with 40 CFR 144.55 (b)(2); and
5. Written authorization to commence injection has been granted by the Director.

**PART II**  
**WELL SPECIFIC CONDITIONS FOR UIC PERMITS**

**A. CONSTRUCTION**

1. **Siting [§146.12(a)]** - The injection well shall inject only into the formation at the depths listed on the cover page of this permit. At no time shall injection occur into a formation which is or is above the lowermost formation containing, within one quarter mile of the well bore, an underground source of drinking water.
2. **Casing and Cementing [§146.12(b)]** - Notwithstanding any other provisions of this permit, the permittee shall case and cement the well in such a manner so as to prevent the movement of fluids into or between USDWs for the expected life of the well. The casing and cement used in the construction of this well are shown in Part III(E) of this permit and in the administrative record for this permit. Any change shall be submitted for approval by the Director before installation.
3. **Tubing and Packer Specifications [§146.12(c)]** - The permittee shall inject only through tubing with a packer set within the long string casing at a point within or below the confining zone. The tubing and packer used in the well are represented in engineering drawings contained in Part III(E) of this permit. Any changes shall be submitted by the permittee for the approval of the Director before installation.
4. **Wellhead Specification [§144.51(i)(4)]** - The permittee shall install and maintain a female coupling and valve on the wellhead, to be used for independent injection pressure readings. Further, the permittee shall install a sampling port for waste sampling consistent with the permittee's waste sampling procedures, if applicable.

**B. OPERATIONS [§146.13]**

1. **Injection Pressure Limitation** - Except during stimulation, the permittee shall not cause or permit the injection pressure at the wellhead to exceed the maximum limitation which is specified in Part III(A) of this permit. In no case shall injection pressure initiate fractures or propagate existing fractures in the confining zone or cause the movement of injection or formation fluids into a USDW.
2. **Additional Injection Limitation** - No waste streams other than those identified in Part III(F) of this permit shall be injected. Every twelfth month the permittee shall submit a certified statement attesting to compliance with this requirement.
3. **Annulus Fluid and Pressure** - The permittee shall fill the annulus between the tubing and the long string casing with a fluid approved by the Director and identified in the administrative record of this permit. Any change in the annulus fluid, except during workovers or times of annulus maintenance, shall be submitted by the permittee for the approval of the Director before replacement. Except during workovers, the permittee shall maintain a positive pressure on the annulus as specified in Part III(A) of this permit.
4. **Annulus/Tubing Pressure Differential** - Except during workovers or times of annulus maintenance, the permittee shall maintain, over the entire length of the tubing, a pressure differential between the tubing and annulus as specified in Part III(A) of this permit.

5. **Automatic Warning and Automatic Shut-off System** - The permittee shall continuously operate and maintain an automatic warning and automatic shut-off system to stop injection in any of the following situations:

- (a) Pressure changes in the annulus or annulus/tubing differential signifying or identifying possible deficiencies in mechanical integrity; or
- (b) Injection pressure, annulus pressure, or annulus/tubing differential pressure reaches the pressure limits as specified in Part III(A) of this permit.

A trained operator must be on site and within perceptible distance of the alarm at all times when the well is operating. The permittee must test the automatic warning and automatic shut-off system at least every twelfth month. These tests must involve subjecting the system to simulated failure conditions and must be witnessed by the Director or his or her representative during a regularly scheduled inspection unless it proves impossible to resolve scheduling conflicts between the operator and the agency.

6. **Precautions to Prevent Well Blowouts** - In order to prevent the migration of fluids into underground sources of drinking water, the permittee shall maintain on the well at all times a pressure which will prevent the return of the injection fluid to the surface. The well bore must be filled with a high specific gravity fluid during workovers to maintain a positive (downward) gradient and/or a plug shall be installed which can resist the pressure differential. A blowout preventer must be kept in proper operational status during workovers. In cases where the injected wastes have the potential to react with the injection formation to generate gases, the permittee shall follow the procedures below to assure that a backflow or blowout does not occur:

- (1) Limit the temperature, pH or acidity of the injected waste; and
- (2) Develop procedures necessary to assure that pressure imbalances do not occur.

## C. **MONITORING**

1. **Sampling Point** - The injection fluid samples shall be taken at the sampling location as specified in the Waste Analysis Plan, which is included as Part III(F) of this permit.
2. **Continuous Monitoring Devices** - The permittee shall maintain continuous monitoring devices and use them to monitor injection pressure, flow rate, and the pressure on the annulus between the tubing and the long string of casing. If the well is equipped with a fluid level indicator, the permittee shall monitor the fluid level daily. The monitoring results shall be submitted to the Director as specified in Part II(D) of this permit. The permittee shall maintain for USEPA's inspection at the facility an appropriately scaled, continuous record of these monitoring results as well as original copies of any digitally recorded information pertaining to these operations.
3. **Waste Analysis Plan [§144.52(a)(5)]** - The permittee shall comply with the Waste Analysis Plan which is included in this permit as Part III(F).



4. **Ambient Monitoring [§146.13(d)(1)]** - The permittee shall monitor the pressure buildup in the injection zone initially upon completion of the well, and at least once every twelfth month thereafter, including at a minimum, a shut down of the well for a time sufficient to conduct a valid observation of the pressure fall-off curve. From this observation, the permittee shall submit a report including at least a calculation of pressure build-up in the injection zone, injection zone transmissivity, and wellbore skin factor.
5. **Temperature Monitoring** - The permittee shall monitor injectate temperature at least once daily on each day during which injection occurs. If injection occurs during more than one eight-hour period in a day, temperature must be recorded at least once every six hours. The monitoring results shall be submitted to the Director as specified in Part II(D)(1)(f) of this permit.

**D. REPORTING REQUIREMENTS [§146.13(c)]**

Reports shall be delivered to the Director or post marked no later than the end of the month following the reporting period. The permittee shall submit all required reports to the Director at the following address:

United States Environmental Protection Agency 77  
West Jackson Boulevard (WU-16J)  
Chicago, Illinois 60604-3590  
ATTN: Direct Implementation Section

In all reports, actual values for reporting parameters shall be provided. It shall not be acceptable to report "NA" or other non-data values where data is actually available. Tubing pressure and injection pressure shall be synonymous.

1. **Monthly Reports** - The permittee shall submit monthly reports of the following information:
  - (a) A tabulation of maximum injection pressure, a daily measurement of annulus tank fluid level, and minimum differential between simultaneous measurements of injection pressure and annulus pressure for each day of the month;
  - (b) Appropriately scaled graphs showing injection pressure and flow rate and annulus tank fluid level. One graph must include, at a minimum, daily maximum injection pressure and daily average flow rate, on a single, monthly chart.
  - (c) A statement of the total volumes of the fluid injected to date, in the current calendar year, and the current month;
  - (d) A tabulation of the dates, amounts and types of liquid added to or removed from the annulus system during the month, and the cumulative additions and cumulative subtractions for the current month and each of the past 12 months;
  - (e) Any noncompliance with conditions of this permit, including but not limited to:

- (1) Any event that exceeds operating parameters for annulus pressure or injection pressure or annulus/tubing differential as specified in the permit; or
    - (2) Any event which triggers an alarm or shutdown device required in Part II(B)(5) of this permit.
  - (f) The monthly average of the measured values of injectate temperature. If temperature measurements are recorded when the well is not injecting, those measurements will not be included in calculating the monthly average. Records of all temperature measurements must be maintained in accordance with Part I(E)(9)(a) of this permit.
2. **Quarterly Reports** – The permittee shall report at least every quarter the results of the injection fluid analyses specified in the approved Waste Analysis Plan as provided in Part III(F) of this permit. In reporting fluid analyses, the permittee shall identify the waste components of the waste stream as described in the approved Waste Analysis Plan. This report must include statements showing that the requirements of Part I(E)(10) and Part II(C)(3) have been met.
3. **Annual Reports** - The permittee shall report the following at least every twelfth month:
- (a) Results of ambient monitoring required by 40 CFR 46.13(d)(1) and Part II(C)(4) of this permit; and
  - (b) A certified statement attesting that no waste streams other than those identified in Part III(F) of this permit were injected into the well.
4. **Reports on Well Tests and Workovers** - Within forty-five (45) calendar days after the activity, the permittee shall report to the Director the results of demonstrations of mechanical integrity, any well workover, and/or results of other tests required by this permit.

**PART III**  
**ATTACHMENTS**

These attachments include, but are not limited to, permit conditions and plans concerning operating procedures, monitoring and reporting, as required by 40 CFR Parts 144 and 146. The permittee shall comply with these conditions and adhere to these plans as approved by the Director, as follows:

- A. SUMMARY OF OPERATING, MONITORING AND REPORTING REQUIREMENTS (ATTACHED)**
- B. PLUGGING AND ABANDONMENT PLAN (ATTACHED)**
- C. FINANCIAL ASSURANCE MECHANISM (ATTACHED)**
- D. CONTINGENT CORRECTIVE ACTION (ATTACHED)**
- E. CONSTRUCTION DETAILS (ATTACHED)**
- F. SOURCE AND ANALYSIS OF WASTE (ATTACHED)**



**ATTACHMENT A**  
**SUMMARY OF OPERATING, MONITORING AND REPORTING REQUIREMENTS**

CHARACTERISTIC	LIMITATION	MINIMUM MONITORING FREQUENCY	MINIMUM REPORTING FREQUENCY
Injection Pressure	490 psig maximum*	continuous	monthly
Annulus Pressure	100 psig minimum	continuous	monthly
Annulus/Tubing Differential	100 psig minimum above operating injection pressure	continuous	monthly
Flow Rate		continuous	monthly
Annulus Fluid Level		daily	monthly
Cumulative Volume		continuous	monthly
Annulus Fluid Loss		monthly	monthly
Chemical Composition of Injected Fluids**		monthly	quarterly
Physical Characteristics of Injected Fluids***		monthly	quarterly

**Sampling Location:** The sample location is at the well head

\* The maximum injection pressure was determined using the following formula:  $[\{.57 \text{ psi/ft} - (0.433 \text{ psi/ft} \times \text{specific gravity})\} \times \text{depth}] - 14.7 \text{ psi}$ . The maximum injection pressure is dependent upon depth, specific gravity of the injection fluid, and fracture gradient of the injection zone. The Trenton Limestone at 3930 feet was used as the depth and a specific gravity of 1.02 was used for the injection fluid. The fracture gradient of .57 psi/ft is used as a default value, unless a site-specific value is determined pursuant to Part III(A)(B) of this permit, in which case the maximum injection pressure will be modified to reflect the specific value of the fracture gradient in this well. Such modification shall be considered a minor modification as allowed for at 40 CFR §144.41(f). The limitation on injection pressure will serve to prevent injection-formation fracturing.

\*\* Frequency of temperature measurements will be in accordance with Section II(C)(5) of this permit. Reporting of injectate temperature will be in accordance with Section II(D)(1)(f) of this permit. As specified in the Waste Analysis Plan, found in the administrative record for this permit

\*\*\* The daily monitoring of the physical characteristics of the injected fluids shall include the following parameters: Turbidity, pH and Specific Gravity, with monthly reporting of each.

**Maximum Injection Pressure (146.13)**

1. During construction of this well, the permittee shall determine if the maximum injection pressure as specified at Part III(A) of this permit allows sufficient operational flexibility. If sufficient flexibility is allowed for in the maximum injection pressure, the permittee may opt not to proceed with additional testing and the requirements of Part III(A) of this permit shall be met. If the maximum injection pressure calculated prior to direct testing proves insufficient, or another need is identified that requires modifying the maximum injection pressure, the permittee shall conduct one or more of the following tests to ensure that the maximum injection pressure exerted during operation will not propagate existing or open new fractures in any part of the injection zone. In all cases, the permittee shall submit a plan, for the Director's approval, describing the detailed procedures to be followed during any test designed to determine maximum injection pressure. Modification of the maximum permitted injection pressure following a test conducted under Part III(A) of this permit shall follow the procedures set forth for minor permit modifications, as specified at 40 CFR §144.41(f).

(a) **In-Situ Stress Tests**

The permittee shall isolate zones for testing the fracturing pressure by means of a straddle packer assembly, or other comparable means. The zones chosen for testing shall be those predicted to have the lowest fracturing value. The permittee shall use either fresh water to conduct this test or a fluid that is permissible for injection into this well as allowed by this permit. At a minimum, the permittee shall measure the test fluid for its specific gravity and viscosity during the In-Situ Stress test. The results of this test shall be submitted to the USEPA as specified at Part III(A)(2) of this permit. Failure to report test results shall be considered grounds to deny a requested permit modification.

(b) **Step Rate Test**

The permittee shall isolate the entire injection zone by means of a packer assembly, or other comparable means. The permittee shall inject either fresh water for this test or a fluid that is permissible for injection into this well as allowed for in this permit. At a minimum, the permittee shall measure the test fluid for its specific gravity and viscosity during the Step Rate Test. The permittee shall inject into the well at increasing rates, holding each rate step constant. Each rate step shall span the same amount of time (at least 30 minutes per rate step is recommended). The permittee shall attempt to inject at three (3) rates which result in a pressure higher than the injection zone fracture pressure during this test. A Cartesian plot of rate against the final stabilized pressure at each step shall be included as part of the data package submitted to the USEPA. The results of this test shall be submitted to the USEPA as specified at Part III(A)(2) of this permit. Failure to report test results shall be considered grounds to deny a requested permit modification.

(c) **Other Test(s) Approvable by the Director**

The permittee may choose to conduct test(s) other than the two described in

Parts III(A)(1)(a) and (b) of this permit. If so, the permittee shall submit a plan to conduct alternative test(s) to the Director for approval prior to conducting the test(s).

2. **Reporting Maximum Injection Pressure Determination**

The permittee shall report the results of the measurements, tests and determinations conducted in Parts III(A)(1) of this permit within 30 days of their completion.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

**PLUGGING AND ABANDONMENT PLAN**

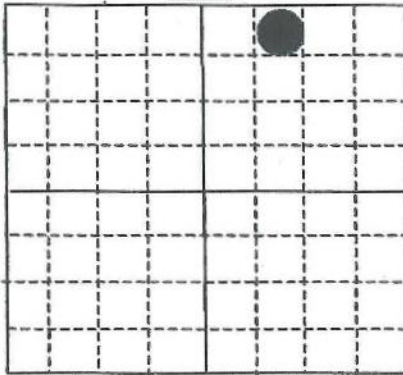
WELL NAME &amp; NUMBER, FIELD NAME, LEASE NAME &amp; NUMBER

NAME, ADDRESS, &amp; PHONE NUMBER OF OWNER / OPERATOR

Edwardsport IGCC Station  
WDW #1  
Edwardsport, Indiana

Duke Energy Indiana, Inc.  
1000 East Main Street  
Plainfield, Indiana 46168

Locate Well and Outline Unit on  
Section Plat - 640 Acres



STATE

Indiana

COUNTY

Knox

STATE PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

NE 1/4 of NW 1/4 of NE 1/4 of Section 12 Township 4N Range 8W

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location 328 ft. From (N/S) N Line of Quarter Section

And 792 ft. From (E/W) W Line of Quarter Section

**TYPE OF AUTHORIZATION**☒ Individual Permit☒ Rule☐ Area Permit

Number of Wells in Area Permit

US EPA Permit Number

**WELL  
ACTIVITY**☒ Class I☐ Hazardous☒ Nonhazardous☐ Class II☐ Brine Disposal☐ Hydrocarbon Storage☐ Enhanced Recovery☐ Class III☐ Class IV**CASING/TUBING/CEMENT RECORD AFTER PLUGGING AND ABANDONMENT**

Size	WT (lb/ft) TBG/CSG	Original Amount (CSG)	CSG to be Left in Well	Hole Size	Sacks Cement Used	Type
13-3/8"	61	660	660	17-1/2"	To Surface	Standard
9-5/8"	36	4,000	4,000	12-1/4"	To Surface	Premium
				8-3/4"	To Surface	Premium

**METHOD OF EMPLACEMENT  
OF CEMENT PLUGS**☒ Balance Method☐ Dump Bailer Method☐ Two Plug Method☐ Other**CEMENT TO PLUG AND ABANDON DATA**

	Plug # 1	Plug # 2	Plug # 3	Plug #	Plug #	Plug #	Plug #
Size of Hole or Pipe in Which Plug Will be Placed (inches)	9-5/8"						
Calculated Top of Plug (ft.)	0						
Measured Top of Plug (ft.)	--						
Depth to Bottom of Plug (ft.)	9,480						
Sacks of Cement to be Used	6,565						
Slurry Volume to be Used (cu ft.)	5,564						
Slurry Weight (lb/gal)	15.6						
Type of Cement, Spacer or Other Material Used	10 ppg Mud*						
Type of Preflush Used	* With Additive						

**DESCRIPTION OF PLUGGING PROCEDURE**

Pull Tubing and Packer.

Spot balanced cement plug across penhole and 200' inside protection casing.

Set CIBP on top of cement plug and inside 9-5/8" casing and place 50' of cement on top.

Displace casing with mud. Set cement plug 100' in and out of base of USDW.

Set top plug from top of USDW to surface.

Cut Casing 3' BGL, top off with cement and weld plate over casing.

**ESTIMATED COST OF PLUGGING AND ABANDONMENT**

Cement	\$ 55,000.00	Cast Iron Bridge Plug	\$ -
Logging	\$ 24,800.00	Cement Retainer	\$ 5,800.00
Rig or Pulling Unit	\$ 72,000.00	Miscellaneous	\$ 42,000.00
Rental Tools	\$ 30,000.00	Total	\$ 199,600.00

**CERTIFICATION**

I certify under the penalty of law that I have examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

NAME AND OFFICIAL TITLE

Jack Stutz GM IGCC

SIGNATURE

Jack Stutz

DATE SIGNED

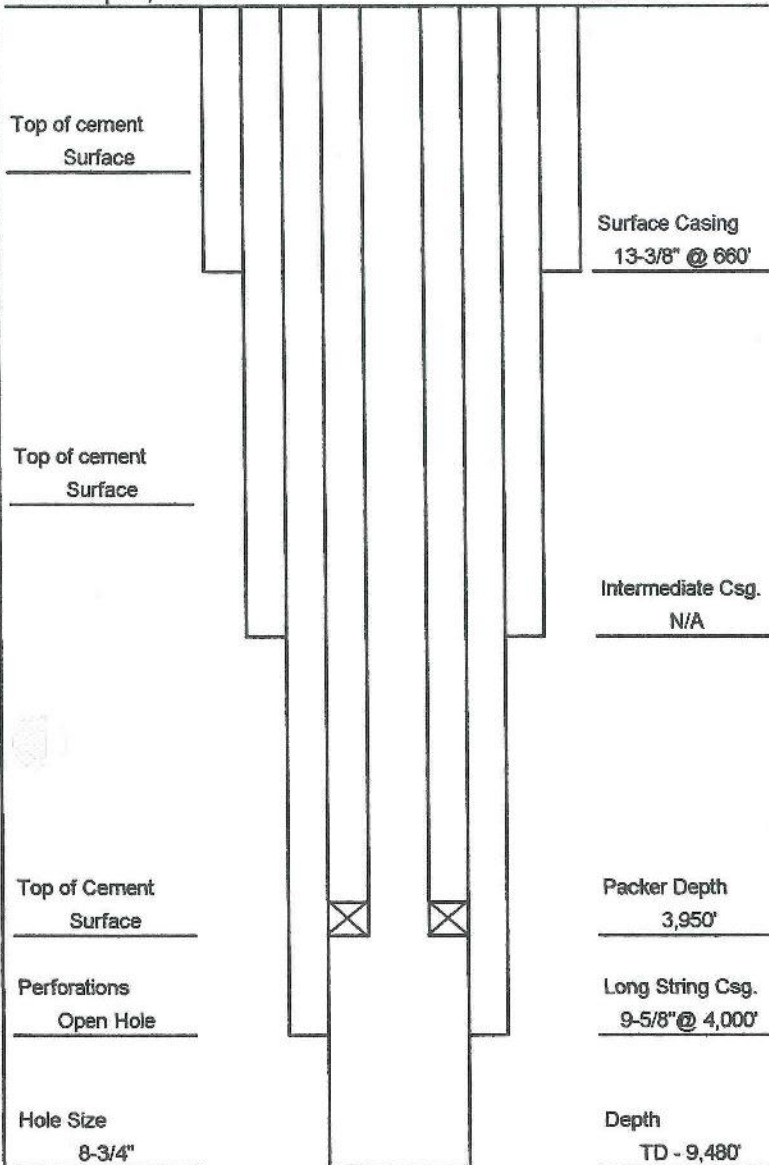
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## ORIGINAL WELL CONSTRUCTION DURING OPERATION

## PLUGGING AND ABANDONMENT CONSTRUCTION

Edwardsport IGCC Station  
WJW #1  
Edwardsport, Indiana

Surface



\*\* Add Any Additional Information

\* May not Apply

Surface

Top Plug Interval  
Surface

\*USDW Base Plug  
Interval  
N/A

\*Intermediate Cut/Rip  
Point Plug Interval  
N/A

\*Middle Plug Interval  
N/A

\*Long String Cut/Rip  
Point Plug Interval  
N/A

Bottom Plug Depth  
9,480'

\*Mechanical Plug Depth  
N/A

\*\* Add Any Additional Information

\* May not Apply

Surface Casing  
13-3/8" @ 660'

USDW Base  
555'

\*Intermediate  
Cut/Rip Depth  
N/A

\*Intermediate Csg.  
N/A

\*Long String Csg  
Cut/Rip Depth  
N/A

Long String Csg.  
9-5/8" @ 4,000'

Depth  
TD - 9,480'

## LIST OF ALL OPEN AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED

Specify Open Hole/ Perforations/ Varied Casing	From	To	Formation Name
Open Hole Interval	4,000'	9,480'	Trenton top - 3,930'
			Black River top - 4,055'
			Ancell/St. Peter top - 4,630'
			Potosi top - 5,880'
			Eva Claire top - 7,280'
			Mt. Simon top - 8,280'



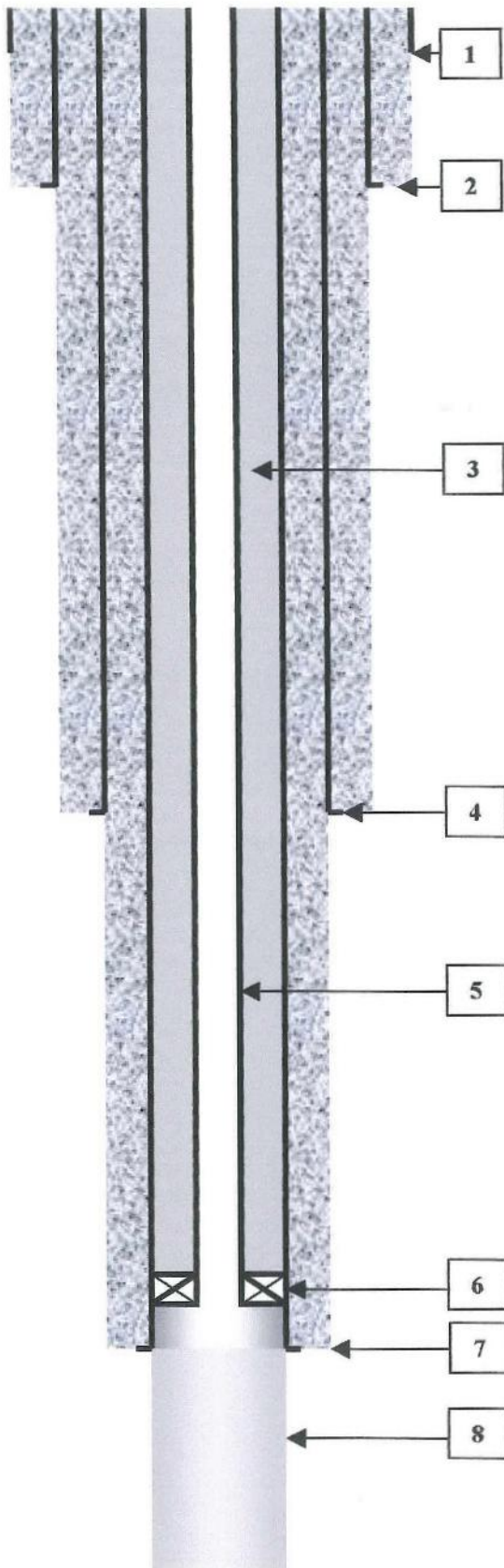
**ATTACHMENT C**  
**FINANCIAL ASSURANCE MECHANISM**

Duke Energy Indiana has demonstrated financial responsibility to properly plug and abandon the Class I non-hazardous well by using a financial statement. This must be updated on an annual basis.



**ATTACHMENT D**  
**CONTINGENT CORRECTIVE ACTION**

There is no corrective action needed at this time.



**1. Conductor Casing:** 20", 94 ppf, 0.438" wall, H-40, STC (or Welded). Driven or set in 26" augured hole to 75' BGL

**2. Surface Casing:** 13-3/8", 61 ppf, J-55, STC in 17-1/2" hole at 660' BGL. Annulus cemented to surface with Premium cement as detailed in Table M-1. Cement volume based on 120% of the annular volume calculated from open-hole caliper log.

**3. Injection Tubing/Casing Annulus:** Filled with corrosion inhibited brine water of specific gravity 1.1 to 1.2.

**4. Intermediate Casing:** 9-5/8" in 12-1/4" hole as detailed in Table M-2. Design based on setting depth to be determined between 3000 feet and 7000 feet. Annulus to be cemented to surface in one or two stages as dictated by setting depth. Cement volume based on 120% of annular volume calculated from the open-hole caliper log.


**5. Injection Tubing:** 4-1/2", 11.6 ppf, L-80, LTC with corrosion resistant inner lining.

**6. Injection Packer:** 7" by 4-1/2", hydraulically set packer with latching seal assembly.

**7. Long String Casing or Liner (Optional):** 7", 26 ppf, N-80, LTC in 8-1/2" hole. Casing setting depth to be determined during drilling. Target depth is at the top of the primary injection interval as determined by open-hole logs, cores, drill stem tests, and sample analysis. This string may be set as a liner, overlapping into the bottom of the intermediate casing. The annulus will be cemented to surface or to the top of the liner according to Table M-1.

**8. Open Hole Completion** from the base of the 7" casing (or liner) to total depth

NOT TO SCALE

<b>SUBSURFACE</b> 			HOUSTON, TX SOUTH BEND, IN BATON ROUGE, LA
<b>FIGURE M-1</b> Duke Energy of Indiana Schematic of Proposed Wells			
DATED: 12/20/06	APPROVED BY: RTB	JOB NO. 60F5923	
DRAWN BY: JDB	CHECKED BY: RWS	SCALE: N/A	

**ATTACHMENT F**  
**SOURCE AND ANALYSIS OF WASTE**

The permittee is allowed to inject waste into this well limited to the following:

1. Fresh water (during well tests and when the system is switched between waste streams),
2. A buffer fluid (during well tests and during well abandonment only);
3. Formation water from the injection formations that is captured during well stimulations or workovers; and

The text of the Duke Energy Indiana, Inc Edwardsport IGCC Station Waste Analysis Plan is included below, though the attachments and appendices to the Plan are not. They are found in the Administrative Record for this permit.



**WASTE ANALYSIS PLAN**

**DUKE ENERGY INDIANA, INC.  
EDWARDSPORT IGCC STATION  
EDWARDSPORT, INDIANA**

**SUBSURFACE PROJECT NO. 60F5923**

**March 2007  
Revised April 2008  
Revision 2: August 8, 2008  
Approved August 15, 2008**

**PREPARED AND SUBMITTED BY:**

**SUBSURFACE TECHNOLOGY, INC.  
South Bend, Indiana**

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## 1.0 INTRODUCTION

### 1.1 Purpose

Duke Energy Indiana, Inc. (DEI), is applying for a permit to install and operate eight Class I non-hazardous injection wells for the disposal of aqueous blowdown waste associated with a coal gasification electrical power generating facility. The Edwardsport IGCC station, located in Knox County, Edwardsport, Indiana. The proposed wells will be operated under the United States Environmental Protection Agency (USEPA) Underground Injection Control program and follow federal rules and regulations as defined in 40 CFR 146.

The requirements of 40 CFR Section 146.13(b)(1) specify that any operator of a Class I underground injection well monitor and analyze the fluids injected into the well such that:

*"The analysis of the injected fluids {shall be monitored} with sufficient frequency to yield representative data of their characteristics."*

Additionally, 40 CFR Section 146.68(a)(1) specifies that:

*"The owner or operator shall develop and follow an approved written waste analysis plan that describes the procedures to be carried out to obtain a detailed chemical and physical analysis of a representative sample of the waste, including the quality assurance procedures used."*

This Waste Analysis Plan (WAP) fulfills the applicable requirements of the permit application process as stated in various 40 CFR sections. This document was prepared following guidance as illustrated in the USEPA Region 5 Underground Injection Control (UIC) Section Regional Guidance #8 issued January 21, 1994 entitled Preparing a Waste Analysis Plan at Class I Injection Well Facilities.

### 1.2 Waste Description and Generation

Wastewater consists of an aqueous blowdown waste associated with a coal gasification electrical power generating facility. As the facility generating the wastestream for injection has not been built as of the time of this plan preparation, estimated values of the expected wastestream have been included as Appendix A to this Waste Analysis Plan. Estimated values do not indicate any hazardous constituents.

### **1.3 Waste Storage Transportation and Disposal**

The wastewater generated will be piped to a water treatment facility where the influent will be filtered prior to the injection pumping system and the injection wells.

Other than required process retention times, there will be no long term storage prior to treatment or injection. Appendix B depicts a block flow diagram of the proposed process for the Edwardsport facility.

### **1.4 Operating Data**

Estimated average injection rate while in operation: 600 gallons per minute (gpm) (total-all wells)

Estimated injection pressure while in operation: 233 pounds per square inch (psig) (per well)

### **1.5 External Transport and Disposal Procedures**

Duke does not anticipate any wastewater leaving Duke property. In the event of well failure, wastewater will be diverted from the treatment facility, via pipeline, to other injection wells.

### **1.6 Project Responsibility**

Duke's Station Manager will have the primary responsibility to ensure all WAP conditions are met. The Station Manager is also responsible for coordination and selection of the subcontracted laboratory used to support the analyses associated with this WAP.

A fully qualified laboratory will be performing the analytical requirements of the WAP. It is the primary responsibility of the laboratory to ensure that all of the laboratory QA functions are fulfilled.

## **2.0 SAMPLING ACTIVITIES**

The following parameters will be analyzed for one or more of the following reasons:

- required to show that the waste is characteristically non-hazardous per 40 CFR 261
- required per the USEPA Region 5 guidance document
- required by Duke for optimal injection well system performance



## 2.1 Sample Parameters/Analytical Method/Sampling Frequency

<b>SAMPLING</b>	
<b><u>PARAMETER</u></b>	<b><u>FREQUENCY</u></b>
pH	Daily
Eh	Daily
Specific Conductance	Daily
Specific Gravity	Daily
Temperature	Daily

<b><u>PARAMETER</u></b>	<b><u>ANALYTICAL METHOD</u></b>	<b><u>SAMPLING FREQUENCY</u></b>
Arsenic	SW846-6010B	Quarterly
Barium	SW846-6010B	Quarterly
Cadmium	SW846-6010B	Quarterly
Chromium	SW846-6010B	Quarterly
Lead	SW846-6010B	Quarterly
Selenium	SW846-6010B	Quarterly
Silver	SW846-6010B	Quarterly
Mercury	SW846-7470A	Quarterly
Total Dissolved Solids	EPA 160.1	Quarterly
Total Organic Carbon	SW846-9060	Quarterly
Volatile Organics	SW846-8260B	Quarterly
Semi-volatile Organics	SW846-8270C	Quarterly

For quality control purposes, field duplicate samples will be collected, at a minimum annually, in an effort to document the effectiveness of the sampling techniques and the analytical system.

## 2.2 Sampling Frequency Justification

The sampling frequency presented in this WAP was based on process knowledge of the operational conditions and estimated values of the waste stream. As the waste stream is non-hazardous, the sampling frequency proposed is a reasonable monitor of the waste stream. The frequency specified will provide the necessary monitoring to insure identification of any potential fluctuations in the stream. Additionally, this WAP allows for supplemental, or modified, sampling when system anomalies are suspected.

## **2.3 Sampling Location**

Duke has identified a primary sampling location from which wastewater injectate will be collected. The primary sampling point, a manual spigot located at the discharge point of the final filtration unit, will be used for all specified sampling events. This spigot will be located on the wastewater main discharge line, such that no other piping is connected to the main prior to the wellhead.

## **2.4 Sampling Protocol**

The sampling protocols include the collection of operational data at the wellhead and the collection of samples at the appropriate sample points.

### **2.4.1 Sampling Protocol (Analytical)**

The sample will be obtained at the primary sample point by carefully opening the spigot valve to allow the sample to flush to the local sump drain for one minute. After the flush period, appropriate sample containers will be filled with the final filtered wastewater (quarterly, a second set of containers will be filled as a field duplicate).

Each sample container is labeled with the:

- date of collection
- time of collection
- sampler initials
- sample ID "injection well"
- bottle sequence (1 of 3)

A Chain-of-Custody must be initiated that includes at a minimum the:

- date of collection
- time of collection
- sampler signature
- sample ID "injection well"
- analyses to be performed
- pertinent sampling notes

## **2.5 Sampling Personnel**

Only those Duke individuals who are thoroughly familiar with the safety and operational characteristics of the injection well system and the requirements of this document will perform or assist in sampling.

The Duke sampling staff will possess site familiar training in the proper sampling protocols specified in this WAP. Additionally, they will possess the required training and site knowledge to perform the sampling tasks safely.

Duke personnel will be primarily responsible for the operation, maintenance and corrective action documentation of the injection well system.

Duke sampling personnel will be primarily responsible for coordinating sampling activities with the lab, performing sampling as outlined in Section 2.4, preparing and completing all required sample labels and chain-of-custody (COC) and transporting samples to the laboratory for analysis.

## **2.6 Chain-of-Custody**

The following COC procedures have been developed to insure that all samples collected remain intact and representative, until all analytical procedures are conducted. These procedures include both field and laboratory custody requirements.

### **2.6.1 Field Custody Procedures**

Sample containers are labeled as indicated in Section 2.4 immediately after collection. A COC is initiated in the field at the time of collection. After signature, the bottom copy of the COC form is removed and retained by Duke Station personnel. The samples and COC are sent by the field sampling technician to the chosen laboratory.

Upon receipt of the sample at the laboratory, the COC is signed as received by the sample custodian, the sample information is recorded in a computer log and the sample is released to the laboratory for testing.

### **2.6.2 Laboratory Custody Procedures**

The chosen laboratory will utilize strict procedures for sample custody. The QA/QC document in Appendix B illustrates sample guidelines. These guidelines are established to maintain the custody of samples in the laboratory and the legal validity of results generated.

The sample custody procedure outlines the general procedures utilized in the processing of all samples received. The following is to be considered a minimum requirement. The attached CD contains specific details utilized by a typical, qualified laboratory for sample receipt, login, storage, internal sample transfer, storage, analysis, and disposal.



### 2.6.3 Sample Custody Procedure

This procedure is designed to outline the general processes used to initiate and maintain sample custody for samples received at the laboratory. These procedures have been instituted to insure that proper sample custody has been established upon receipt and that this custody is maintained during the entire analytical process. Sample procedures are specified in the attached CD.

#### General Procedure:

When a sample cooler is received, a sample login is immediately initiated. The cooler is inspected externally to determine if any obvious leakage has occurred. The cooler seals are broken and the COC is removed. The cooler contents are inspected for obvious damage or leaks. An infrared thermometer is used to measure the temperature of the samples, and the receipt temperature is recorded on the COC. Upon completion of inspection, the COC is checked against the bottles received. The COC is reviewed and signed.

All samples received at the laboratory are logged into a computerized laboratory data management system, which assigns a unique laboratory sample number to each sample. Each container for a given sample is issued a unique container identification number.

Login personnel determine which analysis is required for a given sample from the information provided on the COC. The COC information is entered into the laboratory data management system.

The sample COC, check list, and any other shipping paperwork are placed into a project file, which is then given to the applicable laboratory project manager who verifies the receipt of the sample, COC information, and analyses logged into the database system.

Labels are generated for each sample container. These labels are durable, water resistant, and printed with indelible ink. The labels include the following information:

- sample number
- client name
- client sample ID
- date received
- date collected
- preservative
- required tests from that container

The sample number serves as the container identification number. Where multiple containers are received for a given container type, they are further identified with a container identification in the format of "1 of 3". This sample number and container number format provides a link between sample analysis and the container used.

Samples are placed in a cooler (maintained at approximately 4°C). Access to the cooler and samples are limited to the technical staff of the laboratory. Sample security is maintained through secured limited access areas.

## **2.7 Bottles and Preservatives**

All samples will be collected in appropriate sample containers supplied by the laboratory. Depending on the analysis involved, chemical preservatives may or may not be necessary. Samples will be transported on ice and stored refrigerated at 4 +/- 2 deg C.

## **2.8 Sample Transport**

All samples will be packaged in a cooler with sufficient ice and packing material. Caution will be taken during handling and transport of the samples to ensure that the sample containers are not damaged.

## **3.0 ANALYSIS INFORMATION**

### **3.1 Analytical Procedures**

Analytical methods are listed in Section 2.1 of the WAP. It is understood that these are the base parameters, and circumstances may necessitate the need for additional testing.

The attached CD details in Table 5.1 aspects of the analytical parameters, including typical lower quantitation limits, analytical method references, units of reporting, and holding times.

### **3.2 Parameter and Quantitation Limit Justification**

The parameters selected for analysis under the WAP are representative of those necessary to monitor and characterize the wastestream. These parameters are analyzed to determine compliance with the UIC permit, and to insure that the waste stream characteristics are consistent.

The parameters selected for analysis under this WAP are consistent with the requirements of the UIC permit. The provision for waste recharacterization, provided in this WAP, eliminates the need for additional routine analyses.

The quantitation limits (outlined in Table 5.1 in the attached CD) reflect realistic levels of detection that can be reasonably reproduced to insure permit compliance, and to allow for the obvious effects of the sample matrix. These limits should be achievable for the analysis indicated, however, when

not obtainable, adequate documentation for matrix interference will be provided.

### **3.3 Waste Recharacterization**

In the event that a significant change is suspected or detected in the waste stream, a provision for waste recharacterization will be implemented. An immediate sampling/resampling of the waste stream will be performed and analyzed for all parameters specified in Section 2.1. This sample will be drawn from the primary sampling point as described in Section 2.3.

Waste recharacterization will be used to determine that the waste being injected into the injection well system is stable, and that any waste stream variation will not impact the underground injection process. It is anticipated that a recharacterization process will take place at least annually to assure the waste stream remains non-hazardous.

## **4.0 QUALITY ASSURANCE/QUALITY CONTROL**

### **4.1 Field QA/QC**

The following general procedures will be followed by sampling personnel:

#### **4.1.1 Equipment Blanks**

Samples for this WAP are drawn from a free flowing spigot, therefore all sampling equipment and containers are dedicated. Equipment Blanks will not be required.

#### **4.1.2 Trip Blanks**

A trip blank will be prepared by the laboratory using preserved containers (as applicable) and filled with reagent grade water. The trip blank will follow the sample containers to the site and through the entire collection and transportation process.

#### **4.1.3 Field Duplicates**

Field duplicates are representative samples taken at the same time of normal sampling using similar sampling techniques. The field duplicates are identified in a generic fashion to limit laboratory knowledge of the sample source. Field duplicates will be analyzed for all parameters. Field duplicates will be analyzed at a frequency equivalent to at least one (1) per calendar year. Additional field duplicates may be required to investigate specific parameters or analytical processes.



## 4.2 Laboratory QA/QC

This section presents the general QA/QC requirements applicable to the analysis of environmental samples, as well as the methods for assessing data quality. The purpose of the QA/QC program is to produce data of known quality that is legally defensible, satisfies applicable data quality objectives (DQOs), and meet or exceed the requirements of the WAP.

Performance of all analytical methods is monitored to assess the accuracy and precision of the procedure. Specific quality control checks are designed to provide the necessary information for method assessment.

The following general elements apply to the chemical analyses performed in the laboratory. *Note that a sample detailed QA/QC program is attached to this WAP as a CD (AppendixB.)*

### 4.2.1 Elements of Quality Control - Chemical

A preparation batch is a group of samples that are carried through an applicable preparation technique (e.g. digestion, distillation, or extraction) at the same time using the same reagents and conditions. An analytical batch is a batch of samples that are analyzed using the same instrument and conditions within the same time period. The identity of each batch is unambiguously recorded as a unique "Batch ID" so that a reviewer can identify the QC samples associated with a group of samples.

The type of QC samples that may be utilized and their use are identified below. The specifics regarding frequency, acceptance criteria, and corrective action are included in the attached CD. Specifics regarding the requirements of these QC samples are detailed in the individual standard operating procedures.

### 4.2.2 Calibration

Instruments and support equipment are calibrated in accordance with the referenced analytical methods. Details of calibration procedures are contained in the laboratory SOPs. For the analyses selected, all target analytes are included in the initial and continuing calibrations regardless of their need in a given environmental sample.

If the calibration acceptance criteria are not met, the operating curve may be narrowed either by eliminating the low point or high point of the curve (providing all project criteria are still met.) For multi-analyte calibrations, specific analytes may be eliminated from the low or high points. Otherwise, the entire calibration curve is repeated. Elimination of any of the inner levels of the calibration in order to meet QC acceptance criteria is allowed provided that all analytes are eliminated in that level and the required minimum number of calibrated levels remain.

#### **4.2.3 Surrogates (SURR)**

Surrogates are used to evaluate accuracy, method performance, and extraction efficiency in organic procedures. Surrogates shall be added to environmental samples, quality control samples, and blanks.

#### **4.2.4 Initial Calibration Verification (ICV)**

A second source standard containing all target analytes is analyzed after each initial curve, to verify the validity of the calibration. This standard must be from a separate source or lot number from that used for calibration. Unless specified in the reference method, the ICV is at a concentration near the midpoint of the calibration range.

If the acceptance criteria are not met for the ICV, corrective action steps will include the following. When deemed appropriate, the analyst may take lesser corrective action.

- perform corrective action (e.g. prepare new standard, rinse system, etc.)
- analyze another calibration verification. If acceptance criteria are not met in this second consecutive (immediate) calibration verification, then perform one of the following. Either,
- demonstrate performance after corrective action with two consecutive successful calibration verifications, or
- a new initial instrument calibration must be performed.

The acceptance criteria must be met before samples can be analyzed. However, sample data associated with unacceptable calibration verification may be reported if the verification indicates high bias and the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

#### **4.2.5 Initial Calibration Blank (ICB)**

A reagent blank is analyzed after the ICV and prior to the analysis of environmental samples. A blank may also be analyzed after high concentration samples to demonstrate that carryover contamination does not exist.

Samples associated with an ICB indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

#### **4.2.6 Interference Check Sample (ICS)**

Interference check samples are used in inductively coupled plasma analyses to verify background

and inter-element correction factors.

Samples associated with an ICS indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

#### **4.2.7 Method Blank (MB)**

The method blank goes through all applicable preparation steps and is used to document non-contamination of the entire analytical process.

The MB is considered a batch control parameter. Samples associated with a MB indicating high bias are re-prepared and analyzed. The only exceptions are samples that indicate a non-detectable concentration despite the MB result, or where the project DQOs are met and an appropriate qualifier is reported.

#### **4.2.8 Laboratory Control Sample (LCS)**

The LCS is prepared with analyte-free water or, where available, a purchased solid matrix spiked with representative analytes. The LCS shall be spiked with a second source standard at a level near or below the midpoint of the calibration curve for each analyte. This QC sample shall be carried through the entire preparatory and analytical procedure to document the accuracy of the entire analytical process.

The LCS is considered a batch control parameter. Samples associated with a LCS that fails to meet the acceptance criteria for recovery are re-prepared and analyzed. The only exceptions are samples that indicate a non-detectable concentration when the LCS indicates high bias, or where the project DQOs are met and an appropriate qualifier is reported.

#### **4.2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)**

A matrix spike and matrix spike duplicate are separate aliquots of sample spiked with known concentrations of analyte using a second source standard. The spiking occurs prior to sample preparation and analysis. Samples used for the MS/MSD are chosen at random. This allows for the evaluation of all sample matrices over time. The MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve.

The MS/MSD are matrix-specific quality control samples and are used to assess the bias for accuracy and precision of a method in a given sample matrix. The MS/MSD accuracy recovery is not solely used to assess batch control.

Samples having an indigenous concentration greater than or equal to 4 times the spiked amount are



considered not applicable for spike analysis at that level. Where the sample chosen for MS/MSD analysis is one of a group of samples submitted from a site with homogeneous character and the MS/MSD require that the sample is re-prepared and analyzed, all samples from that Sample Delivery Group should be re-analyzed under similar conditions. If the acceptance criteria are not met in two separately prepared analyses, the failure is considered matrix specific for that sample and the results yielding better recovery are reported with an appropriate qualifier.

#### **4.2.10 Duplicate (DUP)**

Applicable to analyses where MS/MSD are not, duplicate samples are analyzed using identical recovery techniques and treated in an identical manner. Duplicate sample results are used to assess the precision of the entire analytical process. Samples used for the DUP are chosen at random. This allows for the evaluation of all sample matrices over time.

The DUP is a matrix-specific quality control sample and is used to assess the bias of a method due to a given sample matrix. The DUP is not used to solely assess batch control. If the acceptance criteria (%RPD) are not met, the sample and its duplicate must be re-prepared and analyzed. Relative Percent Difference is calculated only where the two values are greater than or equal to 5 times the PQL. If the values are below 5 times the PQL, the acceptance criteria are  $\pm 1$  PQL of each other.

Where the sample chosen for duplicate analysis is one of a group of samples submitted from a site with homogeneous character and the DUP requires that the sample is re-prepared and analyzed, all samples from that Sample Delivery Group should be re-analyzed under similar conditions. If the acceptance criteria are not met in two separately prepared analyses, the failure is considered matrix specific for that sample and the results yielding better recovery are reported with an appropriate qualifier.

#### **4.2.11 Post-digestion Spikes (PDS)**

A PDS is applicable only to digested metals analyses and those general chemistry (wet chemistry) analyses that include a preparation step (e.g. cyanide, nitrogen - ammonia, and phenolics). A post-digestion spike may be analyzed to assist in the assessment of matrix interference when the MS and MSD fail to meet the accuracy acceptance criteria. In addition, a PDS can be used as a troubleshooting tool. The spiking solution is added to a sample aliquot just prior to analysis thereby evaluating the matrix effect on the analysis process only and not the preparation portion. Samples having an indigenous concentration greater than or equal to 4 times the spiked amount are considered not applicable for spike analysis at that level.

If the MS/MSD fail to meet the accuracy acceptance criteria and the PDS is within the acceptance criteria, matrix interference should be suspected. If the MS/MSD and PDS fail to meet the accuracy acceptance criteria, matrix interference is probable and the sample, MS/MSD, and PDS should be



reprepared and analyzed. A smaller sample size should be considered as means to negate the apparent matrix interference.

#### **4.2.12 Serial Dilution (SD)**

As a troubleshooting tool, it may be necessary to analyze a serial dilution of a sample. The results of a 1:5 serial dilution should agree with each other within 5% (unless stated otherwise in the reference method). These criteria are for evaluating the matrix effect in a new or unusual matrix and not for comparing results for a sample diluted because it was above the calibration range of the instrument.

#### **4.2.13 Continuing Calibration Verification (CCV)**

A second source standard containing all target analytes is analyzed to verify that the calibration curve remains valid. This standard must be from a separate source or lot number from that used for calibration. Unless specified in the reference method, the ICV is at a concentration equivalent to the midpoint of the calibration range.

If the acceptance criteria are not met for the CCV corrective action steps include the following. When deemed appropriate, the analyst may take lesser corrective action.

- perform corrective action (e.g. prepare new standard, rinse system, etc.)
- analyze another calibration verification. If acceptance criteria are not met in this second consecutive (immediate) calibration verification, then perform one of the following. Either,
- demonstrate performance after corrective action with two consecutive successful calibration verifications, or
- a new initial instrument calibration must be performed.

Sample data associated with unacceptable calibration verification may be reported if the verification indicates high bias and the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

#### **4.2.14 Continuing Calibration Blank (CCB)**

A reagent blank is analyzed after the CCV. A blank may also be analyzed after high concentration samples to demonstrate that carryover contamination does not exist.

Samples associated with a CCB indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

#### **4.2.15 Control Charts/Tabulations**

Control chart-type data are retained by the laboratory for all quality control sample types. Where allowed by the reference method, laboratory generated acceptance limits may be statistically prepared for Surrogate recovery, LCS recovery, MS recovery for accuracy, and MSD/DUP recovery for precision. Statistical outliers are removed and a minimum of the 50 most recent data points is used to update the limits. When used, lab generated acceptance limits are updated on a minimum annual basis. Control limits are established at the average plus-and-minus three standard deviations ( $X \pm 3\sigma_{n-1}$ ) unless otherwise required in the reference method.

#### **4.2.16 Subsampling**

When removing a portion of an environmental sample, appropriate care and technique is used in order to obtain a representative sub-sample. For water samples this includes thoroughly shaking the sample container in order to mix any solids. It is appropriate to shake filtered groundwater samples as any particulate in the filtrate is from the original sample. For solid and semi-solid samples this includes stirring the sample in order to homogenize any stratified layers within the sample container.

These techniques do not apply to removing an aliquot for the analysis of total organic halides (TOX), or total organic carbon (TOC).

#### **4.2.17 Sample Containers**

Most containers are purchased certified clean from a commercial vendor. These containers are ready for use and require no additional monitoring prior to use. Containers that are purchased without certification will be verified clean prior to shipment.

### **4.3 Calibration Procedures - Laboratory Analyses**

All analytical calibration procedures utilized at the laboratory have been developed to meet or exceed the requirements specified in SW-846, (current) edition, and EPA 600/4-79/020. These procedures are strictly adhered to at all times.

#### **4.3.1 Accuracy and Traceability of Calibration Standards**

All standards and reagents are tracked from their initial preparation through their use in the preparation and analytical batches. Standards purchased from an outside vendor are, where available, traceable to the National Institute of Standards Technology (NIST). A Certificate of Analysis, or similar document of traceability, is kept in the appropriate standards preparation log. Purchased standards may be used at their prepared and labeled concentration without further verification.

Standards preparation and reagent preparation logbooks are maintained throughout the laboratory. Each logbook is labeled with the laboratory name, unique name/purpose of the logbook, logbook

number, the "start date" and the "end date".

Each stock standard, subsequent dilution, and prepared reagent is given a unique tracking number. When preparing dilutions of a standard the following information is included in the standards log:

- standard source lot number
- standard name
- expiration date
- initials of the preparer
- date prepared
- detailed information of the volume/mass used
- final volume prepared
- diluent
- prepared concentration

The expiration date of a prepared standard is that date on which the stock solution expires. In mixes where there is more than one expiration date for the stock solutions, the earliest date is chosen as the expiration date for the entire mix. Each container is labeled with standard or reagent name, concentration, tracking number, and the expiration date. Containers too small for a label with the required information are labeled with a minimum of the logbook reference number and expiration date. Expired standards are discarded and are not used for the generation of analytical data. Standards are prepared using glassware and delivering devices of known and acceptable accuracy.

#### **4.4 Data Reduction, Review, Reporting - Field Analyses**

Data reduction for field analyses involves the direct recording of values from various meters and instruments. All results generated from field analyses consist of values read directly from continuous monitoring meters. Therefore, no calculations are required in producing the final reported results.

All field analysis raw data is reviewed by Duke Station personnel for accuracy and completeness. Particular attention is paid to the maximum and minimum values recorded, as these values are compared to permit limits for compliance purposes.

#### **4.5 Data Reduction, Review, Reporting - Laboratory Data**

Data reduction involves the handling of raw sample data including, but not limited to, detector response, electrode potential readings, titrant volumes, and gravimetric measurements to achieve final sample concentrations. Automated systems are used for calculation and reduction wherever feasible.



#### **4.5.1 Data Review**

A two-tier technical review of all data is performed and documented.

##### **4.5.1.1 1<sup>st</sup> Level Technical Review**

The laboratory technician performing an analysis reviews all of their own data and is responsible for ensuring that the calculations were properly performed and the quality control requirements were met. A data review checklist is initiated by the technician to document this review. The data review checklist is then given to a peer knowledgeable with the current requirements of that analytical procedure, a senior technician, unit supervisor, or the QA/QC director.

##### **4.5.1.2 2<sup>nd</sup> Level Technical Review**

A peer, senior technician, unit supervisor, or the QA/QC director reviews the data by repeating the verification performed by the laboratory technician. This step is documented through use of the data review checklist.

Acceptable data is then available for review in the laboratory data management system. This is performed through the "QA Validation" function of the database. Anyone able to perform the 1<sup>st</sup> Level or 2<sup>nd</sup> Level Technical review can "validate" the data in the database. This step approves the data for release.

#### **4.5.2 Project Manager Review**

Before the data is released, a project manager will review all final reports for consistency and completeness to ensure that the data meet the overall data quality objectives of the project. This review is intended to verify that those analyses requested on the COC have been performed, the sample information is accurate, and the appropriate data qualifiers have been added.

#### **4.5.3 Quality Assurance Review**

In addition to the tiered review process, the quality assurance department will periodically perform data audits. These audits, required as part of the laboratory quality systems audit program, can be performed for the generation of reports that include quality control data, and as a troubleshooting measure. Batches that are reviewed are chosen on random basis and recreate the calculations of all samples in a given batch.

#### **4.5.4 Reporting**

For each sampling event/sample delivery group, the laboratory will prepare an analytical report. The



analytical report, accompanied by a cover letter will generally contain the following elements.

- Laboratory name, address, and phone number
- Title of "Analytical Results"
- Date reported
- Client name (with address on the cover letter)
- Client project ID
- Work Order and Sample Number
- Client sample identification and description
- Client defined matrix
- Collection date and received date
- Analyte
- Result (at client requested reporting limits and units)
- Reporting limit
- Units
- Applicable data qualifiers and dilution factor
- Date of analysis
- Analytical method reference
- Date of sample preparation
- Analyst initials
- Page numbering

The original chain-of-custody form and the login checklist will be returned with each report. Any deviations from the requirements of the laboratory sample acceptance policy will be noted in the final report on either the cover letter or the login checklist.

#### **4.5.4.1 Report Archive**

Analytical reports generated as part of the Injection well waste analysis sampling will be archived by the laboratory. Individual reports will be maintained in the work order file organized by work order number. In addition to the final report archive, the chosen laboratory will maintain a complete Data Level IV QC data package for each sampling event associated with this Waste

Analysis Plan. The QC documentation will be maintained by the laboratory and made available to Duke upon request.

#### **4.6 Internal Laboratory Audits**

The purpose of auditing is to identify whether the lab is generating scientifically sound and defensible data, and that daily operating systems meet the requirements of this quality assurance plan. It is the responsibility of the laboratory QA Director to perform periodic performance audits

and system audits.

#### **4.6.1 Performance Audits**

Performance audits are conducted periodically throughout the year. Performance audits include proficiency testing samples and detailed data reviews. Findings from these audits are used to evaluate the defensibility and data quality produced by the analytical system. Randomly selected samples from various test methods are evaluated in this process. Deficiencies from these audits are discussed with the analyst. Copies of the reports from these audits are forwarded to the unit supervisors and summarized for upper management in the annual system audit report.

#### **4.6.2 System Audits**

A systems audit is performed on a minimum annual basis. The systems audit is a comprehensive review of the overall quality and measurement system. The purpose of these audits is to confirm compliance with the requirements of the Quality Assurance Plan, and to assess the applicability of the quality system to other certification and regulatory programs. Systems audits identify the presence of the necessary organization, facility, and quality systems needed to provide evidence of the laboratory's capability and competence. Copies of the reports from these audits are forwarded to upper management.

#### **4.7 Laboratory Corrective Action Procedures**

Corrective action is necessary whenever deviations from requirements of the quality system occur. System corrective action is described in this section.

##### **4.7.1 System Corrective Action**

The QA department typically initiates corrective action. This type of action is usually initiated due to poor performance audit results, poor system audit results, or unacceptable results on performance testing samples. Either the unit supervisor or their designee is responsible for investigating the problem and determining the corrective action needed. When the source of the problem has been identified and corrective action suggested, a written record is completed, evaluated and, if appropriate, approved by the unit supervisor and QA department. Documentation of each corrective action is kept on file. The forms used are numbered and monitored by the QA department to ensure that out of control events and actions are documented, and that the corrective actions are appropriate, effective, and complete.

Regardless of the source or projected impact on the system failure, the following systematic approach is used in developing a suitable corrective action. The emphasis of the corrective action is to prevent the problem from reoccurring.

- Define the problem
- Establish the root cause of the problem
- Determine the needed action to resolve the problem and eliminate the root cause
- Assign responsibility for implementing corrective action
- Verify the corrective action has been implemented and has eliminated the problem

## **5.0 SAFETY**

### **5.1 Safety Guidelines**

Sampling activities at Duke will be conducted with the proper personal protective equipment (PPE). Sampling activity will generally be conducted using Level D PPE. The following is a list of specific items to be used by field personnel as defined by Safety Level D:

- Hard Hat
- Safety Glasses with side shields
- Safety shoes
- Heavy work clothes covering legs, shoulders and arms
- Safety gloves

Caution must be exercised at all times when performing sampling activities. In and around the area of the Injection well system various mechanical hazards exist.